

## Claims

[c1] What is claimed is:

1. A method for making a polysilicon film on a semiconductor wafer, the surface of the semiconductor wafer comprising a plurality of particles, the method comprising:

performing a two-step polysilicon deposition process, the two-step polysilicon deposition process comprising:

a first step amorphous silicon ( $\alpha$ -Si) deposition process utilizing a low temperature; and

a second step polysilicon deposition process utilizing a high temperature; wherein the first step amorphous silicon ( $\alpha$ -Si) deposition process is used to avoid nucleation of the polysilicon film growth, which utilizes the particles on the surface of the semiconductor wafer, so as to inhibit occurrences of needle-like particles and defects on the surface of the polysilicon film.

[c2] 2. The method of claim 1 wherein before performing the two-step polysilicon deposition process, at least one photolithography process, one wet etching process, one photoresist stripping process, one wet cleaning process and one thermal oxidation process are performed on the surface of the semiconductor wafer.

[c3] 3. The method of claim 2 wherein the wet etching process comprises a buffer oxide etchant (BOE) etching process and a SC-1 cleaning process.

[c4] 4. The method of claim 2 wherein the wet etching process comprises a megasonic scrubbing process, a SC-1 cleaning process, and a SC-2 cleaning process.

[c5] 5. The method of claim 1 wherein the particles comprise micro particles, organic substances, metallic particles adhered to the semiconductor wafer, and micro-defects.

[c6] 6. The method of claim 1 wherein a temperature of the first step amorphous silicon deposition process ranges from 550 to 650 ° C, and a thickness for the amorphous silicon layer is approximately 100 Å .

[c7] 7. The method of claim 1 wherein a temperature of the second step polysilicon deposition process ranges from 680 to 710 ° C.

[c8] 8. The method of claim 1 wherein the two-step polysilicon deposition process is performed in single wafer type low pressure chemical vapor deposition (LPCVD) equipment.

[c9] 9. A method for forming a polysilicon film on a semiconductor wafer, a surface of the semiconductor wafer comprising a first gate oxide area and a second gate oxide area, the method comprising:  
forming a first gate oxide layer (GOX layer) on the surface of the semiconductor wafer;  
performing a photolithography process and an etching process to remove the first gate oxide layer on the surface of the second gate oxide area;  
performing a cleaning process; and  
performing a two-step polysilicon deposition process to form a polysilicon layer, the polysilicon layer covering the first gate oxide area and the second gate oxide area;  
wherein the two-step polysilicon deposition process comprises a first step low temperature amorphous silicon ( $\alpha$ -Si) deposition process to avoid formation of particles and defects during the formation of the polysilicon layer, and a second step high temperature polysilicon deposition process.

[c10] 10. The method of claim 9 wherein the etching process is a wet etching process.

[c11] 11. The method of claim 10 wherein the wet etching process utilizes a buffer oxide etchant (BOE) as an etching solution.

[c12] 12. The method of claim 9 wherein the cleaning process is a wet cleaning process.

[c13] 13. The method of claim 12 wherein the wet cleaning process comprises:  
performing a megasonic scrubbing process;  
performing a SC-1 cleaning process; and  
performing a SC-2 cleaning process.

